

Application/Control Number: 09/902,748

Page 2

Art Unit: ***

CLMPTO

09/902748

07/12/01

DH

Art Unit: ***

1. A communications system in a modular programmable controller (50) which comprises several smart modules (20,30) provided with its own processing unit (21,31) and which comprises an internal communications bus (5) for connecting the modules of the programmable controller (50) with each other, characterized by the fact that the communications system enables exchanges of information to be performed on the internal communications bus (5) in compliance with the TCP/IP communications protocol and by the fact that, for exchanging information in compliance with the TCP/IP communications protocol, a smart module (20,30) of a programmable controller (50) includes its own IP address (24,34) and a TCP/IP stack (22,32) which may be executed by the processing unit (21,31) of the smart module (20,30).

2. The communications system according to claim 1, characterized by the fact that a modular programmable controller (50) comprises at least a network module (10), connected to an external TCP/IP network (9), enabling a smart coupler (20,30) of the programmable controller (50) to directly perform exchanges of information in compliance with the TCP/IP communications protocol on the TCP/IP network (9), via the internal communications bus (5).

3. The communications system according to claim 2, characterized by the fact that the internal communications bus (5) includes several separate communications channels (6,7) providing for the

Art Unit: ***

simultaneous flow of frames complying with the TCP/IP protocol together with frames complying with other protocols.

4. The communications system according to claim 3, characterized by the fact that a programmable controller (50) includes several network modules (10,10') connected to several internet networks (9,9'), each network module (10,10') using a different communications channel (6,6') for the simultaneous flow of frames on the internal communications bus (5).

5. The communications system according to claim 4, characterized by the fact that, for directly accessing several internet networks (9,9'), a smart module (20) of a programmable controller (50) includes several respective IP addresses (24,24').

6. The communications system according to claim 3, characterized by the fact that, in a programmable controller (50), a network module (10) connected to the TCP/IP network (9) includes:

- a driver (19) for access to the link layer of the TCP/IP network (9),

- a table for storing the IP address of the different smart modules (20,30) of the controller (50), capable of accessing the TCP/IP network (9),

- means (13) for filtering and redirecting the IP frames from the TCP/IP network (9) according to the IP address (24,34) of the corresponding smart modules.

7. The communications system according to claim 6, characterized by the fact that the TCP/IP stack (22,32) of a smart module (20,30) is capable of transmitting and receiving frames with an encapsulation complying

Art Unit: ***

with the link layer of the TCP/IP network (9) and by the fact that the smart module (20,30) has an IP routing table for routing the frames transmitted by the smart module to the network module (10).

8. The communications system according to claim 3, characterized by the fact that, in a programmable controller (50), a network module (10) connected to TCP/IP network (9) includes:

- a driver (19) for access to the link layer of the TCP/IP network (9),

- two IP attachments materialized by a first IP address (15) corresponding to the TCP/IP network (9) and by a second IP address (14) corresponding to the internal communications bus (5) of the controller,

- a TCP/IP stack (2) which may be executed in the network module (10), enabling the frames to be routed between both IP attachments.

9. (Amended) The communications system according to claim 1, characterized by the fact that the link layer of the TCP/IP network (9) is the recommended MAC layer in the Ethernet standard.

Art Unit: ***

10. (Amended) A programmable controller (50) including at least a smart module (20,30) and an internal communications bus (5) for connecting the modules to each other, characterized by the fact that the programmable controller is capable of implementing a communications system according to claim 1.

11. (Amended) Automatism unit characterized by the fact that it includes one or more programmable automata (50) capable of communicating with each other or with the outside world by implementing a communications system according to claim 1.